THE SKY BUS TECHNOLOGY

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ABSTRACT:

This paper confers about the sky bus technology which gives an elaborate detail about the planning and execution of the eco-friendly system of mass urban transport. As a primeval technology, this way of transport system proves India to be the rapid transit industry among other countries of the world. This helps in eliminating the problems faced in metro railways. The sky bus technology provides alternative transportation solution, which is financially available. The sky bus concept is based on the sky wheel introduced in 1989 by Mr. B. Raja ram, director of KRCL at the world congress for railway research.

KEYWORDS: Sky Bus, Economical, Eco-friendly, Mass Transit System, Modern Transportation, Growth of Traffic, Congestion.

1. INTRODUCTION

In today's world, India is becoming one among the developing country in the world's community. Increasing population has become the ultimate obstacle that is faced these days. Transportation and communication is one of the most important aspects which play the vital role in development of a country's economy in a densely populated area. The solutions for mass population transport that are available in these days are; Elevated railways, underground railways and surface railways each of it owning its different ways of drawbacks.

Hence, the government in our country has planned to execute the sky bus technology in the mass populated regions. The sky bus is laid by considering the limits of speed and width limitation of the lane. The capacity of this sky bus is limited by the number of passengers per hour. The Sky bus is an aesthetic and eco-friendly structure. Derailment of sky bus never occurs due to its design of construction. They have no signaling system nor having crossings and points. And its top most advantage is that it can go through any existing road routes, even if there is traffic on roads. Therefore, sky bus is the rapid, low-cost, effective and best mode of transport.

2. THE INVENTOR AND DEVELOPER OF SKYBUS

Mr. B. Raja ram was in 1945. He got 1st Class with Distinction in his Engineering graduate and an M.Tech from IIT Kharagpur. He served a decade in railway open line in diverse categories and another decade in Railway research at IIT and RDSO, worked foreign as consultant until 1990. Er. B. Rajaram was involved with the Konkan railway project from the starting of construction in 1990 as a Chief Engineer, Director (Projects) and ultimately as the Managing Director from 1998 to 2005. Sky Bus Metro concept was first introduced in Bologna University Italy, by him in 1989. To deliver world's first fusion reactor in France as part of International effort involving United States of America, Russia, European Union, Japan, S. Korea and India, in November 2007, Er. B. Rajaram was given the responsibility as Member of the Empowered Board, ITER/India, Dept of Atomic Energy, and Government of India.

Fig no. 1. Er. B. Rajaram B.E., M.Tech, F.I.E IRSE (retd.,)

3. CONSTRUCTION OF SKY BUS TECHNOLOGY

The fastened structure at eight meters high above level of the road gives the support and regulation for powered bogies that can run at 100 kmph, with the coach shells hang beneath, take passengers in air conditioned comfort, can persue existing road routes, and whereas existing traffic on pavement continue. It is attractive and there is no disturbance of a claustrophobic feeling for road users. The Sky Bus is secured in case of derailment, toppling or collision - by design and also by construction, therefore it is safer than the subsisting rail based system. The system is noise - free and pollution - free at the price of Rs. 50 Crore per km, in India. It has capacity to carry 36000 travelers per hour (pph), expandable to 72,000 pph as needed. Without having signaling, points, and crossings, it is a distinctive mass-transit system that can be constructing within 2 years in any packed & congested city. Besides moving people, it can carry standard twenty ft. containers, increasing its capacity use to twice that of other prevailing systems. Since, it exists within the municipal limits and works besides the prevailing roadways.

4. DESIGN LOADS

The sky bus metro is designed by examining diverse factors to attain it as the mode of mass transportation of the successive generation. Safety of passenger and environment, minimum cost of production, noise less motion and economic running are few most significant factors, based upon which this is designed.

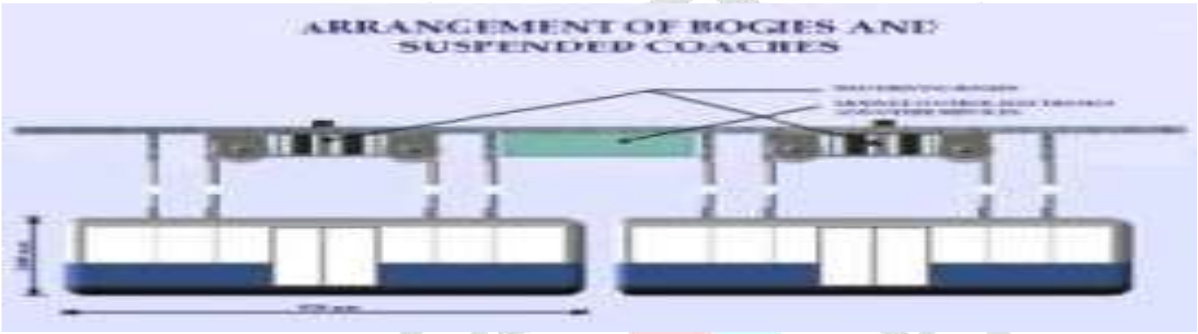

Fig 2. Arrangements of Bogies and suspended coaches

Fig no.3. Arrangements of Bogies

5. COMPONENTS OF SKY BUS

A. SKY WAY

[1] The sky way consists of a concrete box structure 8.4 X 2.4 m consist of a series of piers at a height of 9 - 10 meters above the existing road level.

[2] At the midpoint of the road way, a pile foundation supports around 1 m. diameter columns approximately 8 m. high, and at a spacing of 15 m. all along the roadway.

[3] It has two heavy 52 - 60 kg. / Meter rails fixed with appropriate fastenings within the concrete box support at standard gauge that guide the sky bogie.

[4] There are no points & crossings.

Fig no.4. Sky Bus

B. SKY BOGIE

[1] A Standard two axle bogies could be used in metros at a speed of 100 kmph (but can have higher speed if required, up to 160 kmph) of standard gauge.

[2] Linear Induction motor technology is constituted with 4 th rail driving, which is above the bogie and 3 phase AC motors with regenerative power used.

[3] Third Rail is used for collection of current

[4] Braking - Since the bogie is mounted, 3 levels of brakeing namely - Regenerative, disc brakes and finally, Emergency mechanical brakes are provide to make sure the safety of long distance travelers.

Fig no.5. Sky Bogie

C. SKY COACHES

[1] These are known as double walled light shells with large wide windows hanging from the sky bogies.

[2] Controlled banking on curves is possible. Curves with radius of 50 m can be negotiated.

[3] The coaches of sky bus are air conditioned and the doors are automatic.

[4] They also provide special 4 m wide sliding doors for quick entry and exit of passengers.

[5] Each pair of coach can carry about 300 persons and service every one minute or 30 seconds is possible.

Fig no.6. Sky coaches

D. SKY STATIONS

[1] Unlike conventional mass transit systems, Sky Bus needs smaller stations about 50 meters. long.

[2] Stations are available at every 1 km. It is a natural footbridge across the road. From top to bottom the station provides natural access which is easy.

[3] Service is available at the intrval of every 30 seconds or 1 minute, which means virtually no waiting time for passengers who use sky bus.

[4] The sky bus totally automated without any drivers and access control is electronic by prepaid cards being swiped in.

[5] Stations act as an access facility, and not as passenger holding area.

Fig no. 7. Sky stations

E. TRAVERSER ARRANGEMENTS

[1] There are no crossings and points in the arrangement.

[2] The traverser is the system which is automatically shifted the sky bus units for balancing the loads/ changing routes to as well as shift the units to depot the lines etc.

Fig.no.8. Transverse Arrangement

6. GRAVITY POWER TOWER

Sky bus works on the principle of Gravity Power Tower (GTP).The Gravity Power Tower is a combination of networked microprocessors with controls on main gear system, the high speed power transmission cable and the rolling unit as well as with controllers of the following gravity power towers. In this case there are no electric motors and the fly wheel energy storage is only a secondary element, for receiving energy from the moving rolling unit, drive a dynamo to provide an emergency lighting or siren if needed. The action of a train leaving its tracks accidentally when preventer is a set of pair of solid rubber wheel sets mounted on extensible arms which usually do not touch the sidewalls, but when either predefined acceleration limits are reached or instruction received from the rolling unit controller, they get extended against the sidewalls, to prevent derailment or escaping from the rail tracks, as well as built in disc brakes cause emergency braking, for which a compressed air cylinder provides the energy. The Rail module's steel wheel set exactly the same as used in rail road's, rides over standard rail track, the track having a running opening at the centre to accommodate the downward extended space frame spanning the two bogies. Effectively the Rail Module is comparatively simple, with no conventional traction motors or any traditional braking arrangements. The cargo container or the passenger coach is integrated with the Rail Module's space frame spanning the two bogies. The system could be operated through both elevated or sub-way suspended coach type. The action is totally controlled by the energy management and continuously positively held by the power cable and automated without any visible signals. Safety is enhanced where there is protection against a derailment as well as capsizing of coaches, because the coaches cannot be separated from the tracks that held inside the enclosure box, both for upper and underground options of gravity Powered Rail suspended systems. In case of any power supply failing and the train getting stranded in mid point away from station does not arise, because, unless minimum required energy is available at the Gravity Power Tower to launch a suspended coach to reach next station, the launching will not take place. There is no emission of fuel or chances of any electrical sparks or short circuits along the route of travel of the coaches, reducing the maximum chances of fires and elimination of pollution too. The regular train signal control systems have been eliminated in the Gravity Powered Rail system, as a positive control by launching and receiving Power Transmission cables make sure that the safety of the moving coaches and controlled automatically by the computerized control of the Gravity Power Control in coordination with the on board computer of the rolling mass. The lifts provides the access and the emergency exit steps may be noted and sufficient provisions for safe transit and disaster preventing and mitigating steps can be built in just as in case of existing metro systems. The great advantage is the road grades can be followed as the rail based system is independent on the rail-wheel adhesion for tractive effort. Since the right of way of roads is used, the system can be implemented without any delays and it is environment friendly with no emissions and reliable as gravity. Now for the costs and impact on energy scene of the nation. Take USA as example. For every Mwh of gravity power delivered by Gravity Power Tower, we need atleast10 to 30% as electrical energy to recover. The cost this will vary according to the source of electrical energy. The basic infrastructure cost to provide the gravity tower which is is really comparatively low. So the impact on a country's energy consumption, taking the case of USA is away from the Tower using High Speed Power Transmission cables; It is said that gravity tower recovering back the energy of the 19 Power Mass Module raising the heavy masses back against gravity, from the kinetic energy of an another approaching rolling mass through the High Speed power transmission cables, to the extent up to 98 to 70% of the energy depending on the lead; the balance is made up from external electrical sources; a network of such Gravity Power Towers with High Speed Power Transmission cables linked with each other through rail/road or airways form the gravity power transport systems saving more than 70% of the energy used in transportation systems. Compared to electricity, gravity has the additional unique benefits of saving the generation and distribution expense. In a case of 108 kmph peak speed of urban transport with some halts at 450 m is demonstrated to be completely powered by a Gravity Power, which needs less than 2% of the total electrical energy up.

7. SALIENT FEATURES

1. STANDARD GAUGE RAIL TRACKS
Double elastic fastening with 60kg rails is fitted. This has a standard gauge designed sleepers and also has maintenance free tracks which can withstand load of 20t-30t axle load.

2. DRIVING BOGIES
The powdered under frames, has 100kmph standard gauge which can take 12ton/14ton axle load. They have power-regenerating AC motors and can reach maximum acceleration for about 1.3m/sec.

3. BRAKING
Regenerative electrical braking with air compressed disk of brakes which are mechanical. For stabling crushing load, mechanical emergency brakes are used. The under frames can take in crush loads more than 70t.

4. TRAIN UNIT
Each unit of train is about 20m-30m in length with two wagons and the coaches are separated into 2*9.5m compartments joined by entryway doors.

5. CAPACITY OF 20 M LONG TRAIN UNITS
The sky bus unit is of 20m-30m in length which has two compartments and can carry 400-450 persons at rate of 7-6 person/sq. m. These units could be connected and made into a 3 unit which can hold capacity of 1200-1300 persons.

6. SIGNAL & TRAIN CONTROL
The three simple signal system which is driven by sight line by motorman. Raksha Kavach, a unique safety layer is given in addition. This provides headway of 40sec-60sec.

7. ROUTE CAPACITY

Headway of 60sec can be designed. In peak period, sky bus can carry about 2000-7000 passengers per hour in a single direction.

8. SECURITY AND SAFETY
Each coach is given visual or audio access for security and has monitoring which is centrally computerized. To provide security or protection against swinging loads and to prevent evacuation guidance being overloaded, distributed intelligence systems are used.

9. TRACK CHANGES AND REVERSALS AT TERMINAL
The terminal points reversal of sky bus, track changes or depots has traverse auto driven mechanical system which can handle the units of sky bus of 60m.

10. STATIONS ELEGANT AND SMALL
The stations of sky bus are 60m-70m in length which can handle 3-4units and also stands covering the requirements for the next 25 years.

11. EASY ACCESS
From the footpath that exists, 6m is the limited climb for passengers using staircase and on road the sky bus route is within 500-600m distance.

12. TURNING RADIUS & GRADIENT
The turning radius is designed for 20m and vertical lift as optional. Hence, total demolition of urban property can be avoided.

13. ON LINE MAINTENANCE OF ROLLING STOCK AND TRACKS
By monitoring the vibration signatures continuously and by automatic computer system with advanced method the tracks are inspected periodically. The elements that are existing are governed by the Indian Railway code practices which are applicable to only railway transport.

14. CARGO HANDLING CAPABILITY
The assigned cargo containers which are imported and exported to city outskirts are done automatically.

15. SAFETY CERTIFICATION FOR PUBLIC CARRIAGE
Sky bus has got the will carry international class safety certification from the world class certifiers. They have given us guarantee against capsizing and derailments.

16. TERMINAL CONCEPT
The “grid” system replaces the current concept of the terminal at railways and this eliminates intermodal transfers. Has footpath of 4m wide and less than one minute is the waiting time.

17. LAND REQUIREMENTS FOR ROUTE, STATIONS AND AT DEPOTS

The median of the road is where the typically alignment of the route is located. It is located at a height of 6.5m, as to avoid effects of claustrophobic. Road width is 10m and 20m width is the station location. Outside the urban area is where the depots are located. It needs about 25hect land for station and 10km for service tracks.

18. POWER REQUIREMENTS

For 10km route in tropical climate condition the power needed is 15MW which includes covering traction and air conditioning for comfort at station.

19. QUALITY OF SERVICE AND PRICING

Pricing has been given as 1.50 re per km and dropping to 1 re for regular travel. During peak period, availability of service is less than a minute. The sky bus can handle 40,000 passengers at peak hours. It has an access within 500m to 700m walking distance. Provides A/C during travel at 100kmph. Estimated Construction period is 2-3 years, the total cost tallied is Rs.55 Crore to Rs.60 Crore.

8. ADVANTAGES

1. Every minute, a sky bus carries passengers at a speed of 100 kilometers per hour, travelling distances of more than 45 kilometers in the most cost-effective manner.

2. There are no issues with land acquisition. Since land is not used in this latest technology of 'Sky Wheels,' almost no land acquisition would be necessary.

3. No buildings or gardens are to be destroyed in any public house. There are no environmental risks.

4. It provides the best fire protection as compared to underground metros, allowing for faster evacuation in the event of a fire.

5. Unlike trains and underground metros, there is no capsizing.

6. No one has died as a result of trespassing or falling off the train.

7. There is no waste because it is environmentally friendly and aesthetically pleasing, and there is no noise pollution.

8. There are no traffic queues because you arrive at your destination easily.

9. Low travel costs are less expensive in comparison. Air-conditioned travel is affordable at 50 paisa per mile.

10. Comfort All Sky Buses are air-conditioned, ensuring that your ride is as convenient as possible.

11. It is quick to use; the user only needs to walk a maximum of 500 meters to board the Sky-Bus.

12. Senior citizens and people with disabilities have access to facilities, including a lift.

9. CONCLUSIONS

India has made a technological breakthrough with the Skybus. Skybus is an improved railway technology that eliminates the issues that plague current metro rail networks, such as derailments, crashes, and capsizing, which result in people being crushed. . The reality remains that old traditional railway man, who remained mostly operating and repair experts, may take some time to understand. Skybus is an improved railway technology that removes their long-standing fears of derailments and capsizing! Skybus Metro makes urban transportation a financial dream comes true for administrators—a it's nearly free gift to those who don't have access to government funding! If we really want to address the urban transportation problem, we must remove the doubting Thomas from our minds and embrace the Skybus! The Sky Bus metro is a single technology that has the potential to transform the face of our cities, removing nearly 10 million vehicles from the roads and making cities more livable, while also attracting and sustaining economic activity to generate income.

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